

5 **CLAIMS**

We claim:

1. An apparatus comprising:
a local area network, operably coupled to at least one positron emission tomography
10 imaging system;
a dispensing station to receive a multidose vial of a radiotracer, and to dispense portions
of the radiotracer, at least one positron emission tomography imaging system, the
dispensing station being operably coupled to the local area network; and
a control system operably coupled to the local area network, to receive status information
15 from, and send commands to, the at least one positron emission tomography
imaging system and the dispensing station.
2. The apparatus of claim 1, further comprising a quality control unit, to monitor the
radionuclidic and chemical purity of the radiotracer that is dispensed by the dispensing
20 station, the quality control unit being operably coupled to the local area network,
operably coupled to the control system and operably coupled to the dispensing station.
3. The apparatus of claim 1, wherein the local area network is further operably coupled to a
radioisotope producer and wherein the dispensing station receives the radioisotope from the
25 radioisotope producer.
4. The apparatus of claim 3, wherein the radioisotope producer further comprises a
cyclotron.
- 30 5. The apparatus of claim 3, wherein the radioisotope producer further comprises a linear
accelerator.
6. The apparatus of claim 3, wherein the radioisotope producer further comprises a
radioisotope generator.
- 35 7. The apparatus of claim 1, wherein the apparatus further comprises being mounted on
wheels.

- 5 8. The apparatus of claim 1, wherein a radioactivity shield surrounds portions of the apparatus that are radioactive.
9. The apparatus of claim 1, wherein the radiotracer further comprises nitrogen-13 ammonia.
- 10 10. The apparatus of claim 1, wherein the radiotracer further comprises fluorodeoxyglucose.
11. The apparatus of claim 1, wherein the at least one positron emission tomography imaging system further comprises a plurality of positron emission tomography imaging systems.
- 15 12. The apparatus of claim 1, wherein each positron emission tomography imaging system further comprises:
- a computer system having a graphical user interface operably coupled to the local area network;
- 20 an injector system to extract at least one individual dose from the radiotracer and to inject the at least one individual dose into the living subject, the injector system being operably coupled to the local area network; and
- a physiologic monitoring system operably coupled to the injector system and operably coupled to the living subject.
- 25 13. The apparatus of claim 12, wherein the amount of each individual dose is calculated based on the radioactive half-life of the radiotracer, the projected time of injection into a living subject and high level descriptors of the living subject.
- 30 14. The apparatus of claim 13, wherein the high level descriptors of the living subject further comprise the weight, sex and physical dimensions of the living subject.
15. The apparatus of claim 1, wherein the control system further comprises a computer system.
- 35 16. A medical radiopharmaceutical administration system comprising:
- a local area network, operably coupled to at least one positron emission tomography imaging system and operably coupled to a radioisotope producer;

5 a chemical synthesizer operably coupled to the radioisotope producer, to receive the
 radioisotope, and to produce a radiotracer;
 a dispensing station to receive from the chemical synthesizer a liquid radiotracer in
 quantities suitable for multiple doses of the radiopharmaceutical, and to dispense
 the radiopharmaceutical to the at least one positron emission tomography imaging
10 system, the dispensing station being operably coupled to the local area network;
 and
 a control system operably coupled to the local area network, to receive status information
 from, and send commands to, the at least one positron emission tomography
 imaging system and the dispensing station.

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17. The medical radiopharmaceutical administration system of claim 16, further comprising a
 quality control unit, to monitor the radionuclidic and chemical purity of the
 radiopharmaceutical that is dispensed by the dispensing station, the quality control unit
 being operably coupled to the local area network, operably coupled to the control system
20 and operably coupled to the dispensing station.

18. The medical radiopharmaceutical administration system of claim 16, wherein the
 radioisotope producer further comprises a cyclotron.

25 19. The medical radiopharmaceutical administration system of claim 16, wherein the
 radioisotope producer further comprises a linear accelerator.

20. The medical radiopharmaceutical administration system of claim 16, wherein the
 radioisotope producer further comprises a radioisotope generator.

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21. The medical radiopharmaceutical administration system of claim 16, wherein the system
 further comprises being mounted on wheels.

22. The medical radiopharmaceutical administration system of claim 16, wherein the
35 radiotracer is selected from the group consisting of nitrogen-13 ammonia and
 fluorodeoxyglucose.

5 23. The medical radiopharmaceutical administration system of claim 16, wherein the at least one positron emission tomography imaging system further comprises a plurality of positron emission tomography imaging systems.

24. The medical radiopharmaceutical administration system of claim 16, wherein each of the
10 at least one positron emission tomography imaging system further comprises:

 a computer system having a graphical user interface operably coupled to the local area network;

 an injector system to extract at least one individual dose from the liquid

15 radiopharmaceutical and to inject the at least one individual dose into the living subject, the injector system being operably coupled to the local area network; and
 a physiologic monitoring system operably coupled to the injector system and operably coupled to the living subject.

25. The medical radiopharmaceutical administration system of claim 24, wherein the amount
20 of each individual dose is calculated based on type of radiopharmaceutical, a predefined parametric equation, clinical protocol being followed and high level descriptors of the living subject, wherein the high level descriptors of the living subject further comprise the weight, sex and physical dimensions of the living subject.

25 26. A portable medical radiopharmaceutical administration system comprising:
 a local area network, operably coupled to at least one positron emission tomography imaging system;
 a dispensing station to receive a liquid radiopharmaceutical in quantities suitable for
 multiple doses of the radiopharmaceutical, and to dispense the
30 radiopharmaceutical to the at least one positron emission tomography imaging system, the dispensing station being operably coupled to the local area network;
 a control system operably coupled to the local area network, to receive status information from, and send commands to, the at least one positron emission tomography imaging system, the dispensing station, and the quality control unit;
35 a radioactivity shield that surrounds portions of the medical radiopharmaceutical administration system that are radioactive; and
 wheels mounted to the shield.

5 27. The portable medical radiopharmaceutical administration system of claim 26, wherein the portions of the system that are radioactive further comprise the dispensing station and the quality control unit.

28. The portable medical radiopharmaceutical administration system of claim 26, wherein the
10 local area network is further operably coupled to a radioisotope producer and wherein the dispensing station receives the liquid radiopharmaceutical from the radioisotope producer.

29. The portable medical radiopharmaceutical administration system of claim 28, wherein the radioisotope producer further comprises a cyclotron.

15 30. The portable medical radiopharmaceutical administration system of claim 28, wherein the radioisotope producer further comprises a linear accelerator.

31. The portable medical radiopharmaceutical administration system of claim 28, wherein the
20 radioisotope producer further comprises a radioisotope generator.

32. The portable medical radiopharmaceutical administration system of claim 26, wherein the radiopharmaceutical is selected from the group consisting of nitrogen-13, fluorine-18, carbon-11, oxygen-15 and rubidium-82.

25 33. The portable medical radiopharmaceutical administration system of claim 26, wherein the at least one positron emission tomography imaging system further comprises a plurality of positron emission tomography imaging systems and wherein each of the at least one positron emission tomography imaging system further comprises:

30 a computer system having a graphical user interface operably coupled to the local area network;
an injector system to extract at least one individual dose from the liquid radiopharmaceutical and to inject the at least one individual dose into the living subject, the injector system being operably coupled to the local area network; and
35 a physiologic monitoring system operably coupled to the injector system and operably coupled to the living subject.

34. The portable medical radiopharmaceutical administration system of claim 33, wherein the amount of each individual dose is calculated based on type of radiopharmaceutical, a predefined

5 parametric equation, clinical protocol being followed and high level descriptors of the living
subject, wherein the high level descriptors of the living subject further comprise the weight, sex
and physical dimensions of the living subject.

35. A medical radiopharmaceutical administration system comprising:
10 a local area network, operably coupled to at least one positron emission tomography
imaging system;
a dispensing station to receive a nitrogen-13 ammonia in quantities suitable for multiple
doses of the nitrogen-13 ammonia, and to dispense the nitrogen-13 ammonia to
the at least one positron emission tomography imaging system, the dispensing
15 station being operably coupled to the local area network;
a quality control unit, to monitor the amount of radiochemical and the radionuclidic purity
of the nitrogen-13 ammonia that is dispensed by the dispensing station, the quality
control unit being operably coupled to the local area network and operably
coupled to the dispensing station; and
20 a control system operably coupled to the local area network, to receive status information
from, and send commands to, the at least one positron emission tomography
imaging system, the dispensing station, and the quality control unit.

36. The medical radiopharmaceutical administration system of claim 35, wherein the local
25 area network is further operably coupled to a radioisotope producer selecting from the group
consisting of a cyclotron, and a linear accelerator, and wherein the dispensing station receives
the nitrogen-13 ammonia from the radioisotope producer.

37. The medical radiopharmaceutical administration system of claim 35, wherein the system
30 further comprises being mounted on wheels.

38. The medical radiopharmaceutical administration system of claim 35, wherein the at least
one positron emission tomography imaging system further comprises a plurality of positron
emission tomography imaging systems, and wherein each of the at least one positron emission
35 tomography imaging system further comprises:

a computer system having a graphical user interface operably coupled to the local area
network;

5 an injector system to extract at least one individual dose from the nitrogen-13 ammonia
 and to inject the at least one individual dose into the living subject, the injector
 system being operably coupled to the local area network; and
 a physiologic monitoring system operably coupled to the injector system and operably
 coupled to the living subject.

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39. The medical radiopharmaceutical administration system of claim 38, wherein the amount
of each individual dose is calculated based on a predefined parametric equation, clinical
protocol being followed and high level descriptors of the living subject, wherein the high level
descriptors of the living subject further comprise the weight, sex and physical dimensions of the
15 living subject.

40. A medical radiopharmaceutical administration system comprising:
 a local area network, operably coupled to at least one positron emission tomography
 imaging system;
20 a dispensing station to receive liquid fluorodeoxyglucose in quantities suitable for
 multiple doses of the liquid fluorodeoxyglucose, and to dispense the
 fluorodeoxyglucose to the at least one positron emission tomography imaging
 system, the dispensing station being operably coupled to the local area network;
 and
25 a control system operably coupled to the local area network, to receive status information
 from, and send commands to, the at least one positron emission tomography
 imaging system, the dispensing station, and the quality control unit.

41. The medical radiopharmaceutical administration system of claim 40, wherein the local
30 area network is further operably coupled to a cyclotron and wherein the dispensing station
receives the liquid fluorodeoxyglucose.

42. The medical radiopharmaceutical administration system of claim 40, wherein the system
further comprises being mounted on wheels.

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43. The medical radiopharmaceutical administration system of claim 40, wherein the at least
one positron emission tomography imaging system further comprises a plurality of positron
emission tomography imaging systems, and wherein each of the at least one positron emission
tomography imaging system further comprises:

5 a computer system having a graphical user interface operably coupled to the local area
 network;
 an injector system to extract at least one individual dose from the liquid
 fluorodeoxyglucose and to inject the at least one individual dose into the living
 subject, the injector system being operably coupled to the local area network; and
10 a physiologic monitoring system operably coupled to the injector system and operably
 coupled to the living subject.

44. The medical radiopharmaceutical administration system of claim 43, wherein the amount
of each individual dose is calculated based on a predefined parametric equation, clinical
15 protocol being followed and high level descriptors of the living subject, wherein the high level
descriptors of the living subject further comprise the weight, sex and physical dimensions of the
living subject.

45. A medical radiopharmaceutical administration system comprising:
20 a local area network, operably coupled to a plurality of positron emission tomography
 imaging systems;
 a dispensing station to receive a liquid radiotracer in quantities suitable for multiple doses
 of a radiopharmaceutical, and to dispense the radiopharmaceutical to the plurality
 of positron emission tomography imaging systems, the dispensing station being
25 operably coupled to the local area network;
 a quality control unit, to monitor the amount of radio and the radionuclidic purity of the
 radiopharmaceutical that is dispensed by the dispensing station, the quality
 control unit being operably coupled to the local area network and operably
 coupled to the dispensing station; and
30 a control system operably coupled to the local area network, to receive status information
 from, and send commands to, the plurality of positron emission tomography
 imaging systems, the dispensing station, and the quality control unit.

46. The medical radiopharmaceutical administration system of claim 45, wherein the local
35 area network is further operably coupled to a cyclotron and wherein the dispensing station
receives the liquid radiopharmaceutical from the cyclotron.

47. The medical radiopharmaceutical administration system of claim 45, wherein the system
further comprises being mounted on wheels.

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48. The medical radiopharmaceutical administration system of claim 45, wherein a radioactivity shield surrounds portions of the system that are radioactive.

49. The medical radiopharmaceutical administration system of claim 45, wherein the
10 radiotracer further comprises nitrogen-13 ammonia.

50. The medical radiopharmaceutical administration system of claim 45, wherein the radiotracer further comprises fluorodeoxyglucose.

15 51. The medical radiopharmaceutical administration system of claim 45, wherein each of the plurality of positron emission tomography imaging systems further comprises:
a computer system having a graphical user interface operably coupled to the local area network;
an injector system to extract at least one individual dose from the liquid
20 radiopharmaceutical and to inject the at least one individual dose into the living subject, the injector system being operably coupled to the local area network; and
a physiologic monitoring system operably coupled to the injector system and operably coupled to the living subject.

25 52. The medical radiopharmaceutical administration system of claim 51, wherein the amount of each individual dose is calculated based type of radiopharmaceutical, a predefined parametric equation, clinical protocol being followed and high level descriptors of the living subject.

53. The medical radiopharmaceutical administration system of claim 52, wherein
30 the high level descriptors of the living subject further comprise the weight, sex and physical dimensions of the living subject.

54. The medical radiopharmaceutical administration system of claim 45, further comprising a chemical synthesizer operably coupled to the dispensing station, to receive a radioisotope, and to
35 produce a radiotracer, and to transfer the radiotracer to the dispensing station.

55. A radiopharmaceutical administration system comprising:
a local area network, operably coupled to a plurality of positron emission tomography
imaging systems;

5 a dispensing station to receive a liquid radiopharmaceutical in quantities suitable for
multiple doses of the radiopharmaceutical, and to dispense the
radiopharmaceutical to the plurality of positron emission tomography imaging
systems, the dispensing station being operably coupled to the local area network;
a quality control unit, to monitor the amount of radiochemical and the radionuclidic purity
10 of the radiopharmaceutical that is dispensed by the dispensing station, the quality
control unit being operably coupled to the local area network and operably
coupled to the dispensing station; and
a control system operably coupled to the local area network, to receive status information
from, and send commands to, the plurality of positron emission tomography
15 imaging systems, the dispensing station, and the quality control unit,
wherein each of the plurality of positron emission tomography imaging systems further
comprises:
a computer system having a graphical user interface operably coupled to the local
area network;
20 an injector system to extract at least one individual dose from the liquid
radiopharmaceutical and to inject the at least one individual dose into the
living subject, the injector system being operably coupled to the local area
network; and
a physiologic monitoring system operably coupled to the injector system and
25 operably coupled to the living subject.

30 56. The radiopharmaceutical administration system of claim 55, wherein the local area
network is further operably coupled to a cyclotron and wherein the dispensing station receives
the liquid radiopharmaceutical from the cyclotron.

 57. The radiopharmaceutical administration system of claim 55, wherein the system further
comprises being mounted on wheels.

35 58. The radiopharmaceutical administration system of claim 55, wherein the radiotracer
further comprises being selected from the group consisting of nitrogen-13 ammonia and
fluorodeoxyglucose.

5 59. The radiopharmaceutical administration system of claim 55, wherein the amount of each individual dose is calculated based on type of radiopharmaceutical, a predefined parametric equation, clinical protocol being followed and high level descriptors of the living subject.

60. The radiopharmaceutical administration system of claim 59, wherein
10 the high level descriptors of the living subject further comprise the weight, sex and physical dimensions of the living subject.

61. A medical radiopharmaceutical administration system comprising:
a local area network, operably coupled to a plurality of positron emission tomography
15 imaging systems;
a dispensing station to receive a liquid radiopharmaceutical in quantities suitable for multiple doses of the radiopharmaceutical, and to dispense the radiopharmaceutical to the plurality of positron emission tomography imaging systems, the dispensing station being operably coupled to the local area network;
20 a quality control unit, to monitor the amount of radiochemical and the radionuclidic purity of the radiopharmaceutical that is dispensed by the dispensing station, the quality control unit being operably coupled to the local area network and operably coupled to the dispensing station; and
a control system operably coupled to the local area network, to receive status information
25 from, and send commands to, the plurality of positron emission tomography imaging systems, the dispensing station, and the quality control unit,
wherein each of the plurality of positron emission tomography imaging systems further comprises:
a computer system having a graphical user interface operably coupled to the local
30 area network;
an injector system to extract at least one individual dose from the liquid radiopharmaceutical and to inject the at least one individual dose into the patient, the injector system being operably coupled to the local area network; and
35 a physiologic monitoring system operably coupled to the injector system and operably coupled to the patient.

5 62. The medical radiopharmaceutical administration system of claim 61, wherein the local area network is further operably coupled to a cyclotron and wherein the dispensing station receives the liquid radiopharmaceutical from the cyclotron.

63. The medical radiopharmaceutical administration system of claim 61, wherein the
10 radiopharmaceutical is selected from a group consisting of nitrogen-13 , fluorine-18, carbon-11, oxygen-15 and rubidium-82.

64. The medical radiopharmaceutical administration system of claim 61, wherein the amount of each individual dose is calculated based on type of radiopharmaceutical, a predefined
15 parametric equation, clinical protocol being followed and high level descriptors of the patient, and wherein the high level descriptors of the patient further comprise the weight, sex and physical dimensions of the patient.

65. A system comprising:
20 a local area network, operably coupled to means for positron emission tomography imaging;
 means for dispensing a radiopharmaceutical to the means for positron emission tomography imaging system, the means for receiving and dispensing being operably coupled to the local area network;
25 means for monitoring the quality of the radiopharmaceutical that is dispensed by dispensing means, the means for monitoring being operably coupled to the local area network and operably coupled to the dispensing means;
 means for receiving status information from the means for positron emission tomography imaging, the means for dispensing, and the means for monitoring, the means for
30 receiving being operably coupled to the local area network; and
 means for sending commands to the means for positron emission tomography imaging, the means for dispensing and the means for monitoring, the means for sending being operably coupled to the local area network.

35 66. An apparatus comprising:
 a computer system having a graphical user interface;
 an injector system to extract individual doses from a multidose vial of a radiopharmaceutical and to inject the individual doses into a patient, the injector system being operably coupled to the computer system; and

5 a physiologic monitoring system operably coupled to the injector system and operably
coupled to the patient.

67. The apparatus of claim 66, wherein the computer system receives data from the
physiologic monitoring system, the injector system, a keyboard and the graphical user interface,
10 and sends commands to the injector system.

68. The apparatus of claim 66, wherein the amount of each individual dose is calculated
based on the radioactive half-life of the radiopharmaceutical, the projected time of injection into
a living subject and high level descriptors of the patient.

15 69. The apparatus of claim 66, wherein the high level descriptors of the living subject further
comprise the weight, sex and physical dimensions of the patient.

70. A positron emission tomography imaging system comprising:
20 an injector;
a physiologic monitor operably coupled to the injector; and
a positron emission tomography scanner operably coupled to the physiologic monitor and
the injector.

25 71. The positron emission tomography imaging system of claim 70, wherein the injector is
operable to inject individual doses of a radiopharmaceutical into a patient.

72. The positron emission tomography imaging system of claim 70, wherein the radiotracer
further comprises nitrogen-13 ammonia.

30 73. The positron emission tomography imaging system of claim 70, wherein the radiotracer
further comprises fluorodeoxyglucose.

74. The positron emission tomography imaging system of claim 70, wherein the physiologic
35 monitor is operably to monitor blood pressure and heart activity.

75. The positron emission tomography imaging system of claim 70, wherein the operable
coupling is provided by a local area network.

5 76. The positron emission tomography imaging system of claim 70, further comprising a computer system operably coupled to the local area network, to control dispensing and injection of an individual dose of a radiopharmaceutical into a living subject and to control radiological scanning of the living subject.

10 77. A computer-accessible medium having executable instructions to manage radiotracer production, the executable instructions capable of directing a processor to perform:
 receiving radiotracer material request information;
 determining amount of radioactivity needed from the request information;
 sending production instructions including the amount of radioactivity and the amount of
15 radiotracer to a cyclotron and a synthesis unit; and
 sending instructions to the dispensing station.

 78. The computer-accessible medium of claim 77, wherein the radiotracer request information further comprises the weight, sex and physical dimensions of at least one living
20 subject.

 79. The computer-accessible medium of claim 77, wherein the radiotracer further comprises nitrogen-13 ammonia.

25 80. The computer-accessible medium of claim 77, wherein the radiotracer further comprises fluorodeoxyglucose.

 81. A computer-accessible medium having executable instructions to manage radiotracer production, the executable instructions capable of directing a processor to perform:
30 calculating a required radiotracer dose activity;
 comparing a total activity available in the multidose portion of the radiotracer to the required radiotracer dose activity; and
 notifying of the additional dose activity required and what time the additional, if the comparing indicates that there will be a shortage.

35 82. The computer-accessible medium of claim 81, wherein the notifying further comprises:
 notifying an operator of the computer-accessible medium of the additional dose activity required and what time the additional, if the comparing indicates that there will be a shortage.

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83. The computer-accessible medium of claim 81, wherein the notifying further comprises:
notifying an outside radioisotope supplier of the additional dose activity required and
what time the additional, if the comparing indicates that there will be a shortage.

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84. A computer-accessible medium having executable instructions to manage radiotracer
injection, the executable instructions capable of directing a processor to perform:
injecting the radiotracer into a patient;
initiating scanning of the patient after a first predefined time; and
introducing a pharmaceutical stress agent into the patient.

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85. The computer-accessible medium of claim 84, wherein the computer-accessible medium
further comprises instructions capable of directing a processor to perform:
injecting the radiotracer into patient; and
imaging the patient after a second predefined time.